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Specification

TOOL HOLDER OF MACHINE TOOL

TECHNICAL FIELD

The present invention relates to a tool holder, which has mist cutting fluid fed from a spindle of a machine tool spout from the tip of a shaft-like tool.

PRIOR ART

In machining with a machine tool, much cutting fluid is fed to a work piece or a machining point to cool or lubricate a tool or to remove cutting chips. In this case, there are many problems, such as ill effects to environmental pollution or human health, high cost caused by waste oil disposal of the cutting fluid, deterioration of the life span of tool due to supercooling the work piece, and sliding wear of the tool due to excessive cutting fluid in minute cutting. Besides, since much cutting fluid adheres on the cutting chips in machining, the adhered cutting fluid must be separated in case of disposal or recycling of cutting chips.

In recent years, to settle the above problems, there appear machine tools performing so-called dry cutting that cut as feeding a very small quantity of mist cutting fluid to machining points.

A tool holder used in the machine tool is, for example, constructed as follows. As shown in Fig. 11, a holder rear end part is fixed on a front end of a spindle of the machine tool, and a tool receiving part 8d and mist cutting fluid passages 9c, 8f are formed on a rotating center R in a holder body 7. The tool receiving part 8d receives the outside periphery of a rear end surface of a shaft-like tool 11 fixed on a holder front end part so as to form a closed space 12 in contact with the rear end face. The mist

cutting fluid passages 9c, 8f lead the mist cutting fluid fed from the front end art of the spindle to the closed space 12.

During machining due to the shaft-like tool 11, the mist cutting fluid fed from the spindle reaches the closed space 12 through the passages 9c, 8f, thereafter flowing from the front face of the shaft-like tool 11 through passage holes 11a, 11a formed to the thickness portion thereof.

In the above-mentioned dry cutting, for example, although the shaft-like tool 11 small in diameter of about 1 mm to 5 mm is used, the diameter of the passage hole 11a is about 0.1 mm to 0.5 mm remarkably smaller than that of the passages 9c, 8f.

The small diameter of the passage hole 11a diminishes the amount of outflow of the cutting fluid therethrough per hour, thereby deteriorating the flow velocity of the mist cutting fluid in the passages 9c, 8f.

Under this situation, when the tool holder rotates over about 6000 times per minute, mist cutting fluid for being fed into the passages 9c, 8f or the closed space 12, which is likely to stagnate, is affected by centrifugal force due to the rotation to be promoted liquefying. Since liquefied cutting fluid can not flow easily rather than the mist cutting fluid, it is gradually accumulated in circularity on wall faces of the passages 9c, 8f and comes to restrict the flow of the mist cutting fluid with progress of time. And finally, it becomes difficult to feed sufficient quantity of mist cutting fluid to the tip of the shaft-like tool 11.

The present invention aims to settle the above-mentioned problems and to provide a tool holder of a machine tool having a required quantity of mist cutting fluid continuously flow from the tip of a shaft-like tool.

SUMMARY OF THE INVENTION

To achieve the above-mentioned aim, the first invention of the present invention is constructed as following. That is, a tool holder is so constructed that a tool receiving surface part for receiving a rear end face of a shaft-like tool fixed on a holder front end part so that a closed space in contact with the rear end face can be formed as well as mist cutting fluid passages for leading mist cutting fluid fed from a front end part of a spindle to the closed space are formed on a rotating center of a holder body, and that exhaust passages are formed for opening the closed space 12 (specially, a part of the tool receiving surface part) to the atmosphere except for the passage hole 11a of the shaft-like tool 11 in contact therewith.

According to this, even if only a little mist cutting fluid passes through the passage holes of the tool because the shaft-like tool is small in diameter, the mist cutting fluid in the closed space flows from the exhaust passages to the atmosphere by suitably flux and the mist cutting fluid passages are decompressed. Therefore, the mist cutting fluid in the mist cutting fluid passages has the flow velocity maintained at proper levels to be restricted from liquefying. Besides, even if the mist cutting fluid is liquefied, it is immediately carried into the closed space by the mist cutting fluid in large flow velocity, thereafter flowing to the atmosphere through the passage holes of the shaft-like tool and the exhaust passages.

In this case, it is preferable that the exhaust passages have a circular portion of outer concentric portion of mist cutting fluid passages near the rotating center of the closed space open to the atmosphere. According to this, the tool holder can improve in the symmetry to the rotating center and maintain the rotating stability in high-speed rotation. Besides, according to an affection of centrifugal force, dense mist cutting fluid or droplets are actively led into the passage hole 11a along an inside wall of the closed space to lubricate the tip of the tool.

In the second invention, a holder rear end part is fixed on a front-end part of a spindle of a machine tool. And besides, a tool holder is so constructed that a tool receiving surface part for receiving a rear end face of a shaft-like tool fixed on a holder front end part so that a closed space in contact with the rear end face can be formed as well as mist cutting fluid passages for leading mist cutting fluid fed from a front end part of a spindle to the closed space are formed on a rotating center of a holder body. Here, the tool receiving surface part is excavated rearward to form an excavated part comparatively large in diameter, on the other hand, the front end parts of the mist cutting fluid passages are protruded so as to form a circular space between its peripheral part and the excavated part. Besides, exhaust passages are formed for opening a circular portion of outer concentric portion of the mist cutting fluid passages near the rotating center of the rear end face of the excavated part to the atmosphere. In this case, it is preferable that a diameter of the excavated part 8g is about equal to the distance between the passage holes 11a in a radial direction.

According to this, in addition to the same effects as the first invention, the following effects can be gained. Since the mist cutting fluid in the front-end part of the mist cutting fluid passages flows into the closed space near the rear end face of the shaft-like tool, it is not much affected by the excavated part comparatively large in diameter. Therefore, the mist cutting fluid is prevented from liquefying in the closed space, effectively flowing to the atmosphere through the passage holes of the shaft-like tool. Besides, even if the liquefaction is temporarily excessive in the mist cutting fluid passages, the liquefied cutting fluid is temporarily accumulated in the excavated part. According to this, the liquefied cutting fluid can not interrupt the flow-out of the mist cutting fluid through the passage holes of the shaft-like tool. In this case, the front end part of the mist cutting fluid passages can effectively restrict mixing and stirring

the cutting fluid temporarily much accumulated along the inside periphery of the excavated part with the mist cutting fluid flowing therefrom. Moreover, when the diameter of the excavated part is about equal to the distance between the passage holes 11a, 11a, the dense mist cutting fluid or the droplets near the wall of the excavated part are immediately and actively led to the passage holes 11a, 11a by the centrifugal force affection.

The above-mentioned inventions can be put into concrete as follows.

The tool receiving surface part forms a front-end face of a tool-receiving member adjustable in a longitudinal position in the holder body. According to this, even if the longitudinal position of the shaft-like tool is changed by longitudinally displacing the tool-receiving member, the affections of the above-mentioned inventions can be gained. Here, since the tool-receiving member in the present invention is same as used in a conventional tool holder, different members for forming it are not especially needed.

Besides, a tool receiving member portion of the rear of the excavated part forms a double pipe structure concentric with a rotating center thereof. The inside of an inner tube of the double pipe structure part forms a part of the mist cutting fluid passages, and a circular space between the inner tube and an outer tube thereof forms the first exhaust passage portion due to opening into the excavated part. In this case, the circular space preferably reduces the diameter of the first exhaust passage 8k to the excavated part. According to this, the exhaust passage becomes superior in symmetry to the rotating center of the tool holder, thereby securing the rotation stability thereof in high speed rotation as well as preventing the dense mist cutting fluid or the droplets from flowing therein.

Furthermore, the rearward circular space is so formed as to open to the

atmosphere through an inner space of a holder body portion surrounding the rear end part of the double pipe structure part, the second exhaust passage portion, and a space of a tool fixing part formed to the front end part of the holder body. Here, the second exhaust passage is formed between the tool receiving member and the holder body. Accordingly, the outside periphery of the tool is efficiently lubricated.

Besides, an automatic switching valve is provided in the exhaust passage, which opens when air pressure in the closed space is more than the fixed level. According to this, the automatic switching valve opens only when the mist cutting fluid is apt to stagnate in the mist cutting fluid passages, and the mist cutting fluid flows from the exhaust passages to the atmosphere, thereby decompressing the mist cutting fluid passages. Therefore, the mist cutting fluid therein improves in flow.

Moreover, a cylindrical valve for switching the exhaust passage and a spring for pressing the cylindrical valve forward are externally inserted and mounted on the periphery of the mist cutting fluid passages at the rearward tool receiving member portion of the double pipe structure part. When the air pressure of the closed space is more than the fixed level, the cylindrical valve is pressed and displaced rearward against an elastic force of the spring to open the exhaust passage. Conversely, when it is less than the fixed level, the cylindrical valve is pressed and displaced forward by the elastic force to close it. According to this, the cylindrical valve and the spring become superior in symmetry concerning the rotating center of the tool holder, thereby improving the rotation stability thereof as well as making the automatic switching valve in compact.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view from side sight of a spindle device of a machine tool

having a tool holder showing an embodiment of the present invention.

Fig. 2 is a sectional view from side sight of the tool holder.

Fig. 3 is an enlarged sectional view around a tool receiving member of the tool holder.

Fig. 4 is a sectional view taken on line x-x in Fig. 1.

Fig. 5 is a sectional view taken on x1-x1 in Fig. 1.

Fig. 6 is a sectional view taken on x2-x2 in Fig. 1.

Fig. 7 is an explanatory view showing a proper flow situation of cutting fluid in the tool holder.

Fig. 8 is an explanatory view showing an acting situation of the first deformed embodiment.

Fig. 9 is an explanatory view showing another acting situation of the first deformed embodiment.

Fig. 10 is a sectional view from side sight showing the second deformed embodiment.

Fig. 11 is a sectional view from side sight of a conventional tool holder.

PREFERRED EMBODIMENT OF THE INVENTION

The present invention will be explained as follows with reference to the drawings.

Fig. 1 is a sectional view from side sight of a spindle device of a machine tool having a tool holder showing an embodiment of the present invention, and Fig. 2 is a sectional view from side sight of the tool holder. Fig. 3 is an enlarged sectional view around a tool receiving member of the tool holder. Fig. 4 is a sectional view taken on line x-x in Fig. 1, Fig. 5 is a sectional view taken on x1-x1 in Fig. 1, and Fig. 6 is a

sectional view taken on X2-x2 in Fig. 1.

In these figures, 1 is a spindle of a machine tool, which has a taper hole 1a and parallel large and small holes 1b, 1c on a rotating center R thereof. A cylindrical clamp part 2 comprising a large-diameter part 2a and a small-diameter part 2b as well as a draw bar part 3 for longitudinally displacing the cylindrical clamp part 2 are inserted in the centers of the holes 1a, 1b, 1c. And besides, a plurality of spindle-side collets 4 is circularly engaged between the cylindrical clamp part 2 and the spindle 1.

In this case, a straight mist cutting fluid passage 5 is formed to the centers of the cylindrical clamp part 2 and the draw bar part 3, transferring mist cutting fluid generated outside or inside the spindle 1 to a front f1 of the spindle 1.

The cylindrical clamp part 2 moves in a longitudinal direction f together the draw bar 3. The draw bar is comparative small in diameter. In this case, when the draw bar 3 is displaced to the front direction f1, the large-diameter part 2a goes through from the spindle-side collets 4 group to the front direction f1 and the rear end part of the small-diameter part 2b gets out of the rear end of each spindle-side collet 4 forward to be on the periphery thereof. Accordingly, the circular spindle-side collets 4 group is freely displaced in a radial direction. Conversely, when the draw bar 3 is displaced to a rear direction f2, the large-diameter part 2a is interfitted from the outside of the spindle-side collets 4 group to the rear direction f2 and the rear end part of the small-diameter part 2b is interfitted into the rear end of each spindle-side collet 4. Accordingly, the spindle-side collets 4 group has the diameter enlarged in the maximum to be fixed.

Numeral 6 is a tool holder 6 of the present invention, fixed on the spindle 1 concentrically with the rotating center R thereof. The tool holder 6 is provided with a holder body 7, a tool receiving member 8, a protuberant connecting member 9 and a

tool fixing part 10.

The holder body 7 is symmetrized concerning the rotating center R, comprising a griped part 7a, a cylindrical tapered shaft part 7b, a straight part 7c, an external thread part 7d, a circular concave 7e, a radial surface part 7f, a circular concave 7e, an internal thread 7g, a tapered hole 7h, a thread hole 7i and a small-diameter hole 7j as shown in Fig. 2. The griped part 7a is large in diameter. The cylindrical tapered shaft part 7b is provided to the rear f2 of the griped part 7a, and the straight part 7c is provided to the front f1 thereof. The external thread part 7d is formed to the front of the straight part 7c. The circular concave 7e is formed to the inside periphery of the tapered shaft part 7b, and the radial surface part 7f is formed to the forefront end thereof. The internal thread 7g is formed to the center of the radial surface part 7f. The tapered hole 7h is formed to the front f1 of the inside of the straight part 7c and the thread hole 7i is formed to the rear f2 thereof so as to be communicated to the tapered hole 7h. Besides, the small-diameter hole 7j is formed to the center of the griped part 7a for communicating the internal thread 7g and the thread hole 7i.

The tool receiving member 8 is screwed into the thread hole 7i displaceably in the longitudinal direction f, comprising an external thread part 8a and a slender passage part 8c. The slender passage part 8c extends from the rear end face 8b of the external thread part 8a to the rear direction f2 to be inserted into the small-diameter hole 7j. The front end face of the external thread part 8a forms a tapered tool receiving surface part 8d for receiving the outside periphery of the rear end face of a shaft-like tool 11 such as a drill so as to form a closed space 12 contacting to the rear end face. Besides, the second exhaust passage 8e is provided between the external thread part 8a and the thread hole 7i by forming a longitudinal grooved passage on a

peripheral thread surface of the external thread part 8a. Moreover, a straight forward mist cutting fluid passage 8f comparatively small in diameter is formed to the rotating centers R of the external thread part 8a and the slender passage part 8c.

A circular hole-like excavated part 8g is formed to the center of the tool receiving surface part 8d of the external thread part 8a to the rear direction f2, which has a larger diameter than the forward mist cutting fluid passage 8f. The front end part 8h of the forward mist cutting fluid passage 8f protrudes from the rear end face of the excavated part 8g to the front direction f1, and a forward opening thereof is located to the rear end face of the shaft-like tool 11 as closely as possible.

The rear f2 of the excavated part 8g of a part of the external thread part 8a forms a double pipe structure part as shown in Fig. 3. The inside of an inner pipe part 8i forms a part of the forward mist cutting fluid passage 8f. A circular space 8k between an outer pipe part 8j and the inner pipe part 8i forms the first exhaust passage portion, having the front end opening in the excavated part 8g and the rear end communicating to radial holes 8m, 8m formed inside the thickness part of the front end face of the slender passage part 8c. In this case, the front end of the first exhaust passage portion 8k is located near the rotating center of the rear end face of the excavated part 8g, making the circular portion concentric with the rotating center R an opening a.

The protuberant communicating member 9, as shown in Fig. 2, comprises a comparative short external thread part 9a and a straight protruding part 9b. The external thread part 9a is screwed to the internal thread part 7g to be integrally fixed on the holder body 7. The straight protruding part 9b is so constructed that a straight rearward mist cutting fluid passage 9c for extending the forward mist cutting fluid passage 8f to the rear direction f2 is provided to the rotating center R, and that the

periphery of the rear end part is inserted into the forward-enlarged part 5a of the mist cutting fluid feeding passage 5. In this case, the slender passage part 8c is inserted into the front of the rearward mist cutting fluid passage 9c, and the forward mist cutting fluid passage 8f and the rearward mist cutting fluid passage 9c in the slender passage part 8c are airtightly communicated through a sealing member. Besides, the straight protruding part 9b and the forward-enlarged part 5a are airtightly communicated through a sealing member fixed thereon.

The tool fixing part 10 comprises three tool collets 13 and a fastening nut body 14. The tool collets 13 are circularly interfitted into the tapered hole 7h. The fastening nut body 14 is externally screwed in the external thread part 7d to displace the circular tool side collets 13 group to the longitudinal direction f. In this case, when the fastening nut body 14 is turned to a closing side around the rotating center R, it presses the tool side collets 13 group to the rear direction f2 to reduce the diameter due to interaction with the tapered hole 7h. Conversely, when it is turned opposite to the closing side, it pulls the tool side collets 13 group to the front direction f1 to expand the diameter.

The base part of the shaft-like tool 11 is inserted into the central hole of the tool side collets 13 group. In this case, according to turning the fastening nut body 14 to the above-mentioned one side, the base part of the shaft-like tool 11 is fastened to the tool side collets 13 group to be integrally fixed on the holder body 7 as being drawn to the rear direction f2. Besides, the periphery of the rear end face of the shaft-like tool 11 is airtightly pressed on the tool receiving surface part 8d. Conversely, according to rotating it to the opposite side, the tool side collets 13 group is displaced so as to expand the diameter to enable the base of the shaft-like tool 11 to be pulled out of the central hole.

The shaft-like tool 11 is provided with passage holes 11a, 11a for passing cutting fluid through to one or a plurality of portions (in figures, two portions) of the thickness in a longitudinal direction. A cutting part of the shaft-like tool like this is various sizes in diameter, occasionally 1 mm to 5 mm. The diameter of the passage hole 11a of the cutting part small in diameter like this is, for example, made in about 0.1 mm to 0.5 mm. These passage holes 11a, 11a have inlet openings and outlet openings on the rear end face and on the front end face of the shaft-like tool 11, respectively. In this case, two inlet openings are located in the closed space 12.

In the above-mentioned structure, the forward mist cutting fluid passage 8f and the rearward cutting fluid passage 9c serve for a mist cutting fluid passage of the tool holder 6. Besides, the first exhaust passage portion 8k, two radial holes 8m, 8m, an internal space 15 of the holder body 7 surrounding the peripheral rear part of the double pipe structure part of the external thread part 8a, the second exhaust passage portion 8e, an internal space 16 of the holder body 7 surrounding the front f1 than the external thread part 8a, and a space between the tool side collets 13, etc. serve for an exhaust passage for opening a part of the tool receiving surface part 8d abutted on the closed space 12 to the atmosphere.

An explanation about operation of each part and a using example of the above-mentioned device is as follows.

When fixing the tool holder 6 on the spindle 1, at first, the draw bar part 3 is displaced to the rear direction f2 to displace the cylindrical clamp part 2 thereto, and therefore, the spindle side collets 4 group in circular arrangement is freely displaced to reduce diameter.

Under this situation, the tapered shaft part 7b of the tool holder 6 is pushed into the tapered hole 1a of the spindle 1 with the gripped part 7a gripped. Hence, the

tapered shaft part 7b is deeply inserted into the tapered hole 1a by reducing the diameter of the spindle side collets 4 group due to the inside periphery thereof. The forefront large diameter part 4a of the spindle side collets 4 group is located in the circular concave part 7e of the inside periphery of the tapered shaft part 7b. Besides, the rear end part of the protuberant communicating member 9 is interfitted into the forefront enlarged part 5a to airtightly communicate the mist cutting fluid feeding passage 5 to the rearward mist cutting fluid passage 9c.

Thereafter, the draw bar 3 is pulled to the rear direction f2 to enlarge the diameter of the spindle side collets 4 group. Here, the forefront large-diameter part 4a is engaged to the circular convex part 7e. Then, the tapered shaft part 7b is pulled to the rear direction f2 to be exactly-concentrically fixed on the specified position of the spindle 1 as shown in Fig. 1.

Besides, when the fixed tool holder 6 is detached from the spindle 1, an order for fixedly attaching it thereon is performed in reverse.

When machining a work, first of all, the spindle 1 is rotated, and besides, the mist cutting fluid is fed into the mist cutting fluid feeding passage 5 of the spindle 1 from the rear thereof. In this case, the rotation of the spindle 1 is communicated to the tool holder 6 by friction force caused between the tapered hole 1a and the tapered shaft part 7b to rotate the tool holder 6 concentrically therewith. Here, the mist cutting fluid may be generated outside the spindle 1 or thereinside. The mist cutting fluid inside the mist cutting fluid feeding passage 5 reaches the forward mist cutting fluid passage 8f through the rearward cutting fluid passage 9c, and then, the inside of the closed space 12 covering the rear end face of the shaft-like tool 11, continuously. Thereafter, it spouts from the outlet opening of the front end face of the shaft-like tool 11 through the passage holes 11a, 11a, and besides, flows to the atmosphere in front of

the tool fixing part 10 through the exhaust passage comprising the first exhaust passage portion 8k, the internal space 15 of the thread hole part 7i on the rear of the external thread part 8a, the second exhaust passage part 8e, and each space among three tool side collets 13 of the tool fixing part 10.

Next, the spindle 1 is displaced toward the work to cut it on the front end of the shaft-like tool 11. During this cutting process, the mist cutting fluid flowing out of the front end of the shaft-like tool 11 lubricates cutting portion of the work.

During the work machining like this, when the spindle 1 rotates more than 6000 times per minute in case the passage hole 11a is small as a small-diameter tool, the mist cutting fluid in a passage group comprising the mist cutting fluid feeding passage 5, the rearward mist cutting fluid passage 9c, the forward mist cutting fluid passage 8f and the closed space 12 receives strong centrifugal force due to the rotation of the tool holder 6 to be promoted in liquefaction. In this case, when the mist cutting fluid does not flow out of the exhaust passages to the atmosphere, the flow velocity thereof in the passage group is excessively slow because of a small flow quantity flowing out of the passage holes 11a, 11a. Therefore, the liquefaction of the mist cutting fluid is greatly promoted. The liquefied cutting fluid stagnates in the passage group so as to be gradually accumulated, and consequently, a comparative long time is needed for reaching the tip of the tool.

However, in fact, since the mist cutting fluid reached in the closed space 12 flows out of the exhaust passages to the atmosphere by an adequate flow quantity, the flow velocity thereof in the passage group is increased, and consequently, self-stirring function is increased. Therefore, the liquefaction of the mist cutting fluid can be restricted. Besides, even if the mist cutting fluid is partially liquefied, the liquefied cutting fluid can make the mist cutting fluid in large flow velocity flow into the closed

space 12 rapidly. In this case, the mist cutting fluids in high density and in low density smoothly flow into the passage hole 11a and into the exhaust passages, respectively. Therefore, even if machining time passes away, an excessive of liquefied cutting fluid is not accumulated on the inner wall surfaces of the mist cutting fluid passages 9c, 8f in circularity as usual. Accordingly, the flow quantity of mist cutting fluid flowing out through the passage holes 11a, 11a during the work machining is enough to lubricate the work cutting portion of the shaft-like tool 11. Fig. 7 shows a proper flow situation of the cutting fluid like this. As shown in this figure, the liquefied cutting fluid b barely accumulates only near the inlet opening of the passage hole 11a in circularity besides the insides of the front end part 8h and the closed space 12. The accumulated cutting fluid b never grows even if time passes away.

In the above-mentioned flow of the mist cutting fluid, the forefront of the front end part 8h is located near the rear end face of the shaft-like tool 11. Therefore, the mist cutting fluid flowing out the front end part 8h passes through the excavated part 8g with a radius of the same length as the distance from the center of the passage hole 11a, and one in high density among it flows into the passage holes 11a, 11a according to the centrifugal force.

During the work machining, when an excessive liquefaction temporarily occurs in the mist cutting fluid passages 5, 9c, 8f because the tool holder 6 greatly increases in rotation velocity or the passage holes 11a, 11a are somewhat closed by cutting chips, etc., the liquefied cutting fluid is rapidly fed therefrom to the excavated part 8g by the mist cutting fluid in large flow velocity. Then, it is temporarily accumulated therein, and thereafter flows to the atmosphere through the passage 11a. Accordingly, the mist cutting fluid in the mist cutting fluid passages 5, 9c, 8f can stably flow.

Besides, since there exists an opening a of the first exhaust passage portion 8k on the circular portion around the rotating center R of the rear end face of the excavated part 8g, gas component separated from the mist cutting fluid by the centrifugal force flows therefrom. On the other hand, liquid component remains on the inside periphery of the excavated part 8g in circularity, and it flows out of the passage hole 11a when the remaining quantity increases.

Since the front end part 8h is protruded from the rear end face of the excavated part 8g to the front direction f1, an interference between the forward flow flowing out of the front end part 8h and the rearward flow going for the first exhaust passage portion 8k in the excavated part 8g is restricted. Therefore, the mist cutting fluid can flow effectively in the closed space 12.

The first deformed example of the above-mentioned embodiment will be explained as follows. Fig. 8 is an explanatory view of working situation thereof, and Fig. 9 is an explanation view of another deformed example.

An automatically switching valve 17 is provided in the exhaust passage. The switching valve 17 comprises a cylindrical valve body 17a, a coil-like spring 17b and an engaging ring 17c. The cylindrical valve body 17a is to cover the outlet openings c of the radial holes 8m, 8m, being externally inserted to the outside periphery of the slender passage part 8c airtightly and slidably in the longitudinal direction through a not-illustrated packing. Here, the outside periphery of the slender passage part 8c serves as the peripheral wall part of the forward mist cutting fluid passage 8f. The coil-like spring 17b is to press the cylindrical valve body 17a to the front direction f1, being externally inserted to the outside periphery of the slender passage part 8c through the engaging ring 17c in compressed situation. In this case, the front end face of the cylindrical valve body 17a is formed so as to be airtightly applied on the rear

end face 8b of the external thread part 8a.

Thus deformed embodiment is operated as follows. When the mist cutting fluid in the closed space 12 flows to the atmosphere through the passage holes 11a, 11a over fixed flow quantity, the air pressure in the forward mist cutting fluid passage 8f is comparatively lowered. The flow velocity of the mist cutting fluid flowing in the passage 8f is made in a speed that does not excessively accumulate the liquefied cutting fluid in the mist cutting fluid passages 5, 9c, 8f. Therefore, the mist cutting fluid need not be flowed from the exhaust passages 8k, 8m, 8e. However, in this situation, as shown in Fig. 8, the front end face of the cylindrical valve body 17a is displaced to the front direction f1 by the spring 17b to be airtightly applied on the rear end face 8b of the external thread part 8a. Consequently, the cylindrical valve body 17a blockades the radial holes 8m, 8m. According to this, the mist cutting fluid is prevented from flowing to the atmosphere in vain.

On the other hand, when the mist cutting fluid in the closed space 12 flows to the atmosphere through the passage holes 11a, 11a under the fixed flow quantity, the pressure in the forward mist cutting fluid passage 8f or the closed space 12 is comparatively heightened. The flow velocity of the mist cutting fluid flowing in the passage 8f is decreased enough to excessively accumulate the liquefied cutting fluid in the mist cutting fluid passages 5, 9c, 8f. Therefore, the mist cutting fluid need to be flowed out of the exhaust passages 8k, 8e. However, in this situation, as shown in Fig. 9, the cylindrical valve body 17a is displaced to the rear direction f2 against the spring 17b by an air pressure acting on the inside face thereof to be apart only a distance corresponding to the air pressure from the rear end face 8b. Therefore, the radial holes 8m, 8m are communicated to the atmosphere with proper passage cross-section. According to this, the mist cutting fluid adequately flows to the atmosphere, thereby

preventing the liquefied cutting fluid from excessively accumulating in the mist cutting fluid passages 5, 9c, 8f.

Next, the second deformed example of the above-mentioned embodiment will be explained. Fig. 10 is a sectional view from side sight showing the deformed example. As shown in this figure, the excavated part 8g is not formed to the tool receiving surface part 8d, and the double pipe structure part is formed near the rotating center of the external thread part 8a similarly with the above example. That is, the inside of the inner tube part 8i forms the forward mist cutting fluid passage 8f, and the circular space between the inner tube part 8i and the outer tube part 8j forms the first exhaust passage 8k. Accordingly, there are two differences from the above example, namely, special affections due to the excavated part 8g and the front end part 8h of the forward mist cutting fluid passage 8f are not obtained. Because the closed space 12 is narrow owing to no excavated part 8g and the front end part 8h does not protrude to the front direction f1 in the closed space 12. However, there is an affection based on the flow-out of a part of the mist cutting fluid in the closed space 12 from the exhaust passages 8k, 8e to the atmosphere similarly with the above example.

In this case, in stead of the circular first exhaust passage 8k, a non-circular longitudinal hole as a drill hole may be formed to the thickness of the external thread part 8a outside the forward mist cutting fluid passage 8f.

To simplify the structure, it can so constructed that the mist cutting fluid in the closed space 12 is discharged through the radial holes of the holder body 7 and the external thread part 8a. This construction is also within the range of the present invention.

INDUSTRIAL APPLICABILITY

According to the present invention, the following effects will be gained.

That is, even in case the cutting fluid accumulates because the shaft-like tool 11 is small in diameter and little mist cutting fluid flows to the atmosphere through the passage hole 11a and the flow in the passage is poor, the cutting fluid is rapidly transferred as keeping the flow velocity of the mist cutting fluid in the mist cutting fluid passages 5, 9c, 8k in proper level without changing the shaft-like tool 11. A required quantity of mist cutting fluid can continuously and stably flow from the front end of the passage hole 11a.

Besides, the symmetricalness to the rotating center can be easily maintained, and the rotating stability is made superior even in the high-speed rotation. The high density mist cutting fluid flows to the tip of the tool through the passage hole 11a, and the low density mist cutting fluid goes around to flow to the atmosphere.

In addition to the above-mentioned effects, the following effects can be gained. Even if the liquefaction in the mist cutting fluid passages 5, 9c, 8k is temporarily too much, the liquefied cutting fluid is temporarily accumulated in the excavated part 8g comparatively large in diameter and the mist cutting fluid is stably flowed through the mist cutting fluid passages 5, 9c, 8f and the passage hole 11a. Besides, the rotational influence of the excavated part 8g to the mist cutting fluid flowed from the front end part 8h of the mist cutting fluid passages 5, 9c, 8f is restricted, and the mist cutting fluid flowed into the closed space 12 can be prevented from liquefying therein. Therefore, the mist cutting fluid in the closed space 12 can effectively flow to the atmosphere through the passage hole 11a. Besides, the front end part 8h of the mist cutting fluid passages 5, 9c, 8f can restrict the mist cutting fluid flowing therefrom and much cutting fluid accumulated in the excavated part 12 in circularity along the inside periphery thereof from being mixed and stirred. Accordingly, the mist cutting fluid in

the closed space 12 can effectively flow to the atmosphere through the passage hole 11a.

Moreover, even if the longitudinal position of the shaft-like tool 11 is changed, the above-mentioned effects can be gained, and besides, the cutting fluid can be actively led to the passage hole 11a.

Furthermore, since the exhaust passages 8k, 8e are superior in the symmetricalness to the rotating center of the tool holder, the rotational stability of the tool holder at the time when it is rotated in high speed is satisfactorily secured, and besides, the cutting fluid can be actively led to the passage hole 11a.

Besides, the mist cutting fluid can be applied on the tool without waste.

Moreover, the mist cutting fluid in the closed space 12 can be flowed from the exhaust passages 8k, 8e to the atmosphere only when it is required, thereby preventing from the waste of the mist cutting fluid.

Furthermore, a structure for automatically flowing the mist cutting fluid in the closed space 12 to the atmosphere through the exhaust passages 8k, 8e only when it is required can be compacted without damaging the rotational stability of the tool holder.